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IN THE UNITED STATES PATENT OFFICE

In re Patent Application of:	)		
RODNEY M. LAFOLLETTE, ET AL.	)	Docket:	7310.C
Serial No.: 09/930539	)	Art Unit:	UNKNOWN
Filed: August 14, 2001	)	Examiner:	UNKNOWN
For: MICROSCOPIC BATTERIES FOR MEMS SYSTEMS	)		

DECLARATION OF RODNEY M. LAFOLLETTE, Ph.D.

Honorable Commissioner for Patents
Washington, D.C. 20231

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Sir:

I, Rodney M. LaFollette, declare and state as follows:

1. I am a citizen of the United States of America and a resident of the State of Utah.

2. I have earned a Doctorate in Chemical Engineering from the Brigham Young University.

3. My educational and professional resume is attached as Exhibit "A."

4. I have over 14 years of business and educational experience. This includes extensive experience in the electric battery field.

5. I am an inventor, either sole or joint, of several inventions comprising the subject matter of U.S. patent applications and issued U.S. patents. I am a co-inventor of the invention of the above-identified patent application.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231 on December 11, 2002.

Lynn G. Foster

6. I have worked extensively in research and development pertaining to electric batteries and am thoroughly familiar with various electric battery, capacitor and fuel cell developments.

7. I have been requested to provide an assessment of the claimed subject matter of the above-identified application in comparison with certain prior art patents relied upon by the Examiner in parent U.S. Patent application Serial No. 09/037,801, to provide testimony concerning the prior art and to identify the patentable differences between the prior art relied upon and the claimed invention. A copy of the Office Action in the parent is attached as Exhibit "B".

8. I consider my skill in the electric battery field to be above ordinary skill. If the claimed invention is not obvious to me, based upon the prior art relied upon, it would not be obvious to one of ordinary skill.

9. In the course of functioning as indicated above, I received and reviewed a copy of the above-identified application, as filed.

10. I also received and analyzed a copy of the parent Office Action in the above-identified application mailed 20 February 2001, a copy of the three patents relied upon by the Examiner in said Office Action, and a copy of the Amendment being filed essentially contemporaneously with this Declaration.

11. I was asked to evaluate the 35 USC § 132 objection, the 35 USC § 112 first paragraph rejection and the 35 USC § 103(a) rejections contained within the Office Action.

12. I am familiar with the invention of the above-mentioned application, as originally filed, and the claims as originally filed and as presently constituted, due to the above-mentioned contemporaneous Amendment, because I have studied both. I have also read and studied the three patents relied upon in the said Office Action.

13. In the parent Office Action mailed 20 February 2002 (Exhibit "B"), the Examiner makes the following rejections:

a. Claims 10-43, 51-54, 89-92, 94-97 and 103-109 are rejected under 35 USC § 112 first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

b. Claims 10-12, 15-43, 51-54, 89-92, 94-97 and 103-109 are rejected under 35 USC § 103 (a) as being unpatentable over Arledge et al. 5437941.

c. Claims 10-12, 15-43, 51-54, 89-92, 94-97 and 103-109 are rejected under 35 USC § 103 (a) as being unpatentable over Shokoohi et al. 5110696.

d. Claims 13-14 are rejected under 35 USC § 103 (a) as being unpatentable over Arledge et al.5437941 as applied to Claim 10 above, and further in view of Wrighton et al. 4717673.

14. In making five art rejections mentioned in paragraph 13 immediately above, the Examiner contends as follows:

a. In respect to the paragraph 13 a rejection and a 35 USC § 132 objection:

> The amendment filed 01/11/01 is objected to under 35 USC § 132 because it introduces new matter into the disclosure. 35 USC § 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: (claims 10, 33, 41-43, 51, 89 and 94-95) "<u>the footprint substantially less/smaller than 20 cm^2</u>" (footprint area); (claims 10, 21, 41-43) "<u>the size-congruent</u>" limitation. As to the footprint size, it is noted that specification (page 15, lines 1-7) clearly encompasses "batteries with a very tiny footprint (area), on the order of 0.1 cm^2 down to 0.0001 cm^2". *Thus, the footprint area as instantly claimed is not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor originally had possession of the claimed invention.* As far as the "congruent-size", it is noted that this terminology has not been disclosed throughout the specification.

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The added material which is not supported by the original disclosure is as follows: (claims 10, 33, 41-43, 51, 89 and 94-95) "the footprint substantially <u>less/smaller than 20 cm^2"</u> (footprint area); (claims 10, 21, 41-43) "<u>the size-congruent</u>" limitation. As to the footprint size, it is noted that specification (page 15, lines 1-7) clearly encompasses "batteries with a very tiny footprint (area), on the order of 0.1 cm^2 down to 0.0001 cm^2". *Thus, the footprint area as instantly claimed is not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor originally had possession of the claimed invention.* As far as the "congruent-size", it is noted that this terminology has not been disclosed throughout the specification.

b. In respect to the paragraph 13 b rejection:

The instant claims are drawn to a microscopic recharge battery wherein the alleged inventive concept comprises the microscopic structures. Other limitations include the thin film, the non-conductive base, the materials, the electrolyte influent flow path, the etched cavity and the separators.

Arledge et al. disclose an energy storage device having an electrode consisting of a thin film or metal oxide *deposited on a substrate.* Spherical plastic spacers are uniformly dispersed on the electrode at a maximum density of about 1000 spacers per sq. millimeter of the electrode area. A second substrate also has an electrode formed on it, similar to the first substrate (abstract/col 2, lines 9-33). The first and second substrate are arranged so that the electrodes face each other and are separated by the spherical plastic spacers to form a gap of about 20 microns between electrodes. An electrolyte is filled in the gap. The device may also be formed by using metal foils, and eliminating one or more of the substrates. The use of an electrolyte is optional (abstract/col 2, lines 9-33). It is related to electrical energy storage devices such as electrochemical cells (col 1, lines 9-10/col 5, lines 35-44). The total are of the plane between the two electrodes in the cell is approximately 20 sq. centimeters (col 5, lines 3-6).

Arledge et al disclose that the substrate could not be nonconductive but in the case where the substrate is conductive it could also function as a current collector. A thin film of electrode material would be applied to the face of a substrate. The electrode materials would be applied to the substrate using standard deposition techniques such as sputtering, evaporation, lamination, plating, chemical vapor deposition or plasma spraying (col 2, lines 34-51).

Arledge et al. teach the electrodes are between 0 to about 10,000 Angstroms thick. This is the range of coating thickness that is known to those skilled in the art as a thin film. For example, hybrid microelectronic circuits are made in the range of 100-15,000 Angstroms. However, in some instances the use may wish to deposit a somewhat heavier film of metal or metal oxide, and films up to about 30,000 Angstroms, most preferentially, the film will be between 1000 and 3000 Angstroms thick. The electrode may be patterned by a number of conventional means, including etching (col 2, lines 52 to col 3, line 2). Examples 1 and 2 illustrate two small sheets with about 750 Angstrom and the method to make them. Since the present claims are also directed to a microscopic battery integratable with a microelectronic circuit, it would be capable of being integrated with a microelectronic circuit.

Arledge et al. disclose electrical energy storage device according to the foregoing. However, Arledge et al. do not explicitly disclose the integrated battery with a microelectronic circuit in the specific power output.

In the view of the above, it would have been obvious to one skilled in the art at the time the invention was made to integrate the microscopic battery with a microelectronic circuit as Arledge et al teaches that microelectronic circuits are made with same thin film, method and characteristics used to produce the microscopic thick electrodes. In this regard, this thin film technology is known to those skilled int eh art and therefore it would be obvious to have think film electrodes integrated with a microelectronic circuit deposited on substrate that are held in close proximity and have the capability of producing devices that have very high capacitance per unit volume. This provides a competitive advantage over the conventional art by creating an energy storage device that can store more energy and provide more specific power in a smaller, less complex package than other technologies. Premised on Arledge et al's disclosures, it would be obvious to a skilled artisan to recognize that the dimension of the battery itself is thus totally commensurate to the dimension of the microcircuit or microelectromechanical system, or vice-versa.

c. In respect to the paragraph 13 c rejection:

Shokoohi et al. disclose a rechargeable thin film intercalation electrode battery having a thin film electrode. The battery is assembled directly upon semiconductor devices and integrated circuitry (abstract). It is disclosed that the produced crystalline grain sizes generally larger than about one micrometer which is related to the electrode surface area in typical 0.5 to 1.5 micrometer thin films (col 2, lines 12-17). The thin film electrode for secondary batteries is made under conditions that are compatible with

microelectronics technology (col 2, lines 19-24). The thin film layer is deposited by reactive electrode beam evaporation onto a suitable substrate from a bulk source of the oxide compound, it is obtained a 0.05 to 0.1 micrometer grain size (col 2, lines 30-36/col 2, lines 5-51). The crystalline substrate is coated with the thin film layer in any evaporative or sputtering technique to provide such a buffer layer upon which the electrode compound condenses during the evaporative coating operation (col 2, lines 41-45/col 4, lines 55-59). It is disclosed a substrate of about 10 mm diameter (col 5, lines 50-55).

Shokoohi et al. disclose an electrode structure consisting essentially of a substrate, an inert buffer layer, and thin film layer of the active compound (col 4, lines 26-30). The substrate could comprise GaAs, SI or other semiconductor device materials, in ultimate use with integrated microelectronic circuitry (col 4, lines 39-42). The insulating layer and a metallic buffer layer are also disclosed (col 4, lines 42-47). A think film layer of about 10 mm is useful to ensure effective bonding (col 4, lines 52-54).

Shokoohi et.al. teach that substrate does not react with the electrode compound due to the use of influential substrates such as quartz, s/s, or aluminum. Also, it is disclosed the masking of physical imperfections that might nucleate larger crystal growth (col 2, lines 52-29). Masking as etching produces or adjust patterns or designs on the surface of the electrode substrate. The method of electrode preparation is disclosed (col 2, lines 60-68) including the deposition of film on the substrate until the desired film thickness (col 3, lines 10-112). The electrolyte as well as the anode elements are taught; also the method may be employed for anodes (col 3, lines 24-30/col 3, lines 51-55). By using this method, the electrode compounds may be used in integration of power supplies with microelectronic circuitry (col 4, lines 1-5).

Shokoohi et al. further teach that the cell comprises a body fitting in which are assembled insulating materials and the active cell elements consisting of the cathode, the anode and the intermediate separator of glass cloth (non-metallic) and a solution (col 6, lines 41-56). It is further disclosed the cell performance was tested over series of charge/discharge cycles at varying current densities as shown in Figure 3 (col 6, line 58 to col 7, line 10).

Shokoohi et al. disclose a battery according to the aforementioned aspects. However, Shokoohi et al. do not explicitly disclose the footprint area and the specific power output.

In view of this disclosure, it would be obvious to make a battery having an area on a surface covered (footprint area) by the cell assembly of

less than 20 cm^2 as Shokoohi et al. teaches that in a fabrication of an exemplary film electrode the diameter of the substrate is about 10 mm which is approximately equivalent to an area of 0.785 cm^2. Since the anode may be substantially the same in size as the cathode; the electrodes gap is commensurate to the electrode size and the body fitting in which the components are assembled simply provides a suitable enclosure for the cell, the size of the cell is substantially less than 20 cm^2. Accordingly, the volume require to store the energy is determined by the specific power requirements of the cell. However, if the cells are made of sufficient size, enough energy can be stored to produce a specific charge, energy and/or power output.

d. In respect to the paragraph 13 d rejection:

Arledge et al. is applied and incorporated herein for the reasons above. In addition, Arledge at al do not disclose the sensor system.

Wrighton et al. disclose a polymer based electromechanical device which functions as a sensitive sensor which measures changes in chemical concentration or pH (col 1, lines 32-35); the polymer based microelectronic device amplify very small electrical or chemical signals (col 1, lines 36-39). The device can be incorporated into microelectronic systems and conventional integrated circuitry which are responsible to electrical input (col 1, lines 49-51). The device is useful as car battery (col 2, lines 41-43).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to integrate the sensor system of Wrighton et al. in the energy storage device or Arledge et al. as Wrighton et al. disclose that the device can be incorporated into microelectronic systems and conventional integrated circuitry which are responsible to electrical input. Thus, the microelectronic device may provide very high resolution, stability and rapid response of battery conditions such as changes in chemical concentration e.g. pH, hydrogen, oxygen, and other chemicals.

15. In reply to the Applicant's arguments in the parent application, the Examiner states:

The assertion that the prior art enables only capacitor and does not relate to microscopic sized batteries or does not pertain to batteries is not sufficient to overcome the rejection. **First, it is pointed out that the '941 patent clearly disclose/teach/enable *electrochemical cells (col 1, lines 8-10)*. Moreover, the reference teaches that while the behavior exhibited with these examples is capacitive in nature, by employing different electrode materials, *an electrochemical cell, such as a battery can be created (col 5,***

lines 35-45). **Thus, a skilled artisan would recognize that the battery of the prior art must also be used similarly to the microscopic battery of the instant claims.** Furthermore, even though the reference do not explicitly state the use of a microscopic battery, it is an implicit teaching. In that, the battery of the prior art may be made as the microscopic battery of the instant claims. In this regard, a reference is good not only for what it teaches by direct anticipation but also for what one of ordinary skill might reasonably infer from the teachings. Also, it is not necessary that the prior art suggest expressly or in so many words, the changes or possible improvements the invention intends. It is only necessary that the reference apply the general knowledge clearly present in the prior art.

As to the footprint area, it is noted that both references disclose batteries comprising microcomponents and microcircuitry, since the size of the electrode elements are commensurate to the battery size and the body fitting in which the components are assembled simply provides a suitable enclosure for the cell, the size of the cell is somewhat equal in measure or extent of the components so as to correspond in size, or structural proportion. Thus, the skilled artisan would recognize that the dimension of the battery itself is thus totally commensurate to the dimension of the microcomponents placed inside the battery.

In response to applicant's argument that reference enables only capacitors and it briefly mentions batteries, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicant's arguments do not comply with 37 CFR 1.111 © because they do not clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. Further, they do not show how the amendments avoid such references or objections.

16. In reaching the conclusions and making the assertions which he did in the above-mentioned Office Action, the Examiner made himself a fact and an expert witness, engaged in hindsight reliance based upon the above-identified application, provided erroneous information and made rejections inconsistent with the clear disclosure in the present specification and teachings of the prior art relied upon. See the detailed testimony provided below.

17. As to the 35 USC § 132 objection and the 35 USC § 112, first paragraph, rejection, the amendment in question to the specification and the relevant claim language do not add matter, pertaining to the footprint, to the specification or claims which is not fully based upon the application as originally filed. In this regard, note the following points:

a) The disclosed and claimed microfabricated battery must be size compatible or size congruent with a MEMS-sized microscopic battery, which clearly means the footprint (area) of batteries of this invention must be orders of magnitude smaller than 20 cm^2.

b) The disclosure of the above-identified application contains specific footprint disclosures of battery areas significantly below 20 cm^2. See page 15, line 3, for example.

c) The specification makes it clear that batteries used in the past with MEMS-sized microscopic circuits are too large and therefore not size compatible or size congruent with MEMS and similarly sized microscopic circuits. See page 4, lines 8-18; page 8, lines 16-21; page 10, lines 10-11.

d) The specification clearly discloses size congruency or size compatibility with MEMS. See page 15, lines 2-8, which states:

> The present invention involves microscopic batteries, which comprise a very tiny footprint (area), typically on the order of 0.1 cm^2, and accommodate direct integration into microcircuits, and/or MEMS, either on a retrofit or unitarily with the microcircuit and MEMS at the time of manufacture. The microscopic batteries of the present invention provide a solution to long existing MEMS energy and power management problems of the past, and will significantly enable MEMS technology for increased utilization. The present invention also involves novel methods of making microscopic batteries.

e) Thus, size compatibility or congruency with MEMS or like sized circuit and footprint size are clearly and unambiguously disclosed. One skilled in the art would not disagree.

18. The Applicants have done nothing more than is permitted under MPEP § 608.01 (o), i.e.:

> . . . an applicant is not limited to the nomenclature used in the application as filed, he or she should make appropriate amendment of the specification whenever this nomenclature is departed from by amendment of the claims so as to have clear support or antecedent basis in the specification for the new terms, appearing in the claims. This is necessary in order to insure certainty in construing the claims in the light of the specificaiton.

19. As to whether the Applicants had possession of the invention, attached is Exhibit "C" comprising a photograph of a barely visible microscopic battery made precisely as delineated in the present specification.

20. The Examiner has failed to meet his burden, as required by MPEP § 2163.04, namely:

> A description as filed is presumed to be adequate, unless or until sufficient evidence or reasoning to the contrary has been presented by the examiner to rebut the presumption. See e.g. *In re Marzocchi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971). The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description. The examiner has the initial burden of presenting by a preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a descrioption of the invention defined by the claims. *Wertheim*, 541 f,2d at 263, 191 USPQ at 97.

No reasonable basis has been advanced by the Examiner in support of his contention that the present specification did not originally disclose size congruence and an area substantially below $20cm^2$.

21. In summary, the presently pending claims are not anticipated or made obvious by Arledge along or together with any other reference relied upon because:

a) Arledge discloses a thin-film capacitor that used glass beads (or other comparable materials) dispersed randomly between the two facing electrodes. Arledge boldly though erroneously asserts that their disclosed capacitor is or could be adapted for use as a battery. To alter the Arledge capacitor into a microfabricated battery format and made its size and power compatible with a MEMS would be a quantum leap of major inventive proportions.

b) While Arledge deposits electrodes 12 and 14 on first and second substrates, Arledge does not teach or suggest in the context of a microbattery or a capacitor sacrificial material, removal of sacrificial material, etching, or size and power compatibility with a MEMS.

c) Arledge teaches a thin, large area capacitor. Even if Arledge were a battery, and it is not, the size and nature of the Arledge capacitor would not accommodate internal placement and use within a MEMS.

d) The statement in Arledge that "use of electrolyte is optional" (col 1, lines 61-62) means that Arledge could not be a battery. A battery requires electrolyte.

e) Figure 4 of Arledge is strictly limited to the behavior of a capacitor.

f) In the parent application, a fuel cell patent was withdrawn because fuel cells are a fundamentally different technology than batteries. The same is true of capacitors, when compared to batteries. Correspondingly, the Arledge capacitor patent should be withdrawn.

g) The statement in the "Detailed Description of the Preferred Embodiment" of Arledge (col 2,lines 24-31) that the interelectrode gap is

"defined and maintained by microscopic spacers composed of particles of electrically non-conductive material dispersed randomly between the substrates," and then later OPTIONALLY adding an electrolyte, describes a situation that fundamentally could never work for a battery. The case of the "non-conductive" spacers, without an electrolyte, could never be used in a battery.

h) Both examples described in Arledge are directed to a capacitor with essentially identical electrodes. This type of capacitor is referred to as a "symmetric" capacitor. This of course could not be used as a battery, since there is no electrical potential difference between the electrodes, and hence no battery voltage.

i) If dissimilar electrode materials were used, as suggested by Arledge, an "asymmetric" capacitor would result, which would have grossly inadequate energy storage capacity to power a MEMS. The best capacitors, including psuedocapacitors, have energy densities (per mass) of ~ 1-5 W●hr/kg; batteries require energy densities of 20-400 W●hr/kg. Thus, even when they state that a battery could be created by simply applying different electrode materials, they are still discussing capacitors, including pseudocapacitors.

j) Arledge contains a number of technical inaccuracies. For example, the BACKGROUND section states that "both capacitors and batteries store energy by the separation of positive and negative charges," (column 1, lines 25-26). This is a gross error. Batteries do not store charge through separation of charge, but rather they store energy in the chemical bonds of the electrode materials. This gross misunderstanding of the basics of how a battery functions suggests that

Arledge inventors are far from skilled in the art of battery design and construction. Therefore, any statement that they make with respect to batteries is suspect.

k) The Arledge disclosed embodiments will not work as batteries and cannot be converted to batteries because: (1) the proposed non-use of an electrolyte prevents a battery from working; (2) the electrode materials Arledge mentions as alternative material
are not well suited for use as battery materials and would not product sufficient MEMS power. Battery materials must be prepared with the property crystallinity, size, and other characteristics, to work well. The techniques mentioned by Arledge, (sputtering, etc.) do not produce suitable battery materials. All of the Arledge components (electrodes, separators, etc.), are appropriate for capacitors, but will not result in a useable battery.

l) As disclosed, the Arledge technology cannot be used to make functional batteries, much less MEMS internal batteries. The material that Arledge uses for electrodes (metal foils) and those mentioned as possible replacement (metal oxides), are materials that are optimal for capacitors (high surface area, modest or low reactivity) rather than batteries (which must be highly reactive, bulk materials).

m) Arledge cannot be simply converted to make microscopic batteries as required by the pending claims. Quantum leap and inventive changes would be required, defying the contention that such conversion would be obvious to one skilled in the art. These include, but are not necessarily limited to:

(1) The electrode materials would have to be prepared and deposited differently than does Arledge. For example, they must be heat-treated or

otherwise prepared for stability and electrochemical activity. The deposited materials of Arledge as depicted in Figure 4, are not chemically reactive as would be need for a functional battery.

(2) Microfabrication techniques would have to be applied, though not taught by Arledge, to make cells that are truly microscopic in size. Remember, "small" to Arledge means thin, not small in area (see col 4, lines 25-27; col 5, lines 52-55). The Arledge device comprises an area of 20 cm^2, order of magnitude bigger than the claimed invention. Arledge uses MACROSCOPIC techniques for cell assembly, including applying the epoxy seal and positioning the electrodes (see col 3, lines 4-6, applying a "bead" of adhesive; lines 30-40, "turning the electrodes," and "staggering" them - these would not work in microfabrication of our batteries).

(3) The Arledge separator concept would not work with rechargeable batteries, due to its incomplete separation of the electrodes. Phase changes of battery materials, the growth of dendritic shorts, and shedding of electrode material would cause cell shorting, when the Arledge type of separation is used.

(4) The Arledge capacitor cannot be integrated into a MEMS or like microcircuit, since it does not comprise suitable small cells, and the Arledge macroscopic cell assembly process is not compatible with a MEMS integrated processing. Furthermore, Arledge thin-film electrode materials, to work as a battery, must be exposed to extended high temperatures, which would destroy a MEMS or similar integrated circuit.

Arledge does not have a provision for adapting their capacitor electrode materials for use in batteries, despite their omnibus assertions to the contrary. It is not only non-obvious to an expert as to how to make battery-grade materials using the Arledge process, it may well be impossible. Arledge implies that by simply applying the Arledge thin-film process to deposit different materials, a battery could result. This is not true, as additional non-obvious and inventive steps would be required.

n) Arledge does not satisfy the long unsatisfied need for a battery having a unisize relationship with a MEMS or a non-MEMS microcircuit of congruent size. Given the multi-million if not multi-billion dollars market for such a battery, as stated in the above-identified application, the interpretation of Arledge by the Examiner is misplaced and the alterations of Arledge purposed by the Examiner are ill-founded and do not render any of the old or new claims anticipated or obvious to one of skill in the art. If Arledge anticipated the present invention or made it obvious, the present invention would be on the market.

o) Given the foregoing, it is clear that Arledge addressed a problem significantly dissimilar to Applicant's problem. Arledge provided a different solution to a different problem. Arledge fundamentally teaches away from the claimed invention of the Applicants.

p) Because of its irrelevant teachings, Arledge lacks the technical substance to be considered either a primary or a secondary reference.

q) There is no teaching in Arledge or any other reference that the two references could or should be combined. The Examiner purported combination is based on hindsight.

22. Attached as Exhibits "D", "E" and "F" are my Declaration and Second Declaration and Third Declaration filed in the parent application, the relevant substance of which is incorporated herein reference.

23. Until the present invention, no one of ordinary or extraordinary skill recognized, over a period of many, many years during which the need existed that microscopic battery could be microfabricated so as to be size compatible with a MEMS or similarly sized microcircuit and still have the electrical energy satisfactory to drive the MEMS circuit. Thus, the present discovery, including its methodology, is not obvious to those having skill in the battery field. The present invention, for the first time provides a battery fully integratable with a MEMS or MEMS-sized circuit.

24. The Examiner cites the cell of Shokoohi as a further example of a thin-film battery. As with the other numerous examples of thin-film batteries, the cell of Shokoohi is limited in its energy storage capabilities (per area) due to the resistance of the electrode layers. Shokoohi has more to do with a lower temperature process for depositing lithiated manganese dioxide, than with cell construction. Shokoohi claims to have lowered the processing temperature from around 800° C to under 500° C. However 500° C is still way, way too high for integration with MEMS and other microcircuits. Temperatures under 200 ° C are needed. Therefore, Examiner's conclusion that Shokoohi batteries are integrable represents a groundless, misplaced and impossible hindsight-based dream. The fact is that integration is not possible with temperatures as high as 500°. Finally, a downsized version of the cell of Shokoohi, to make it size-congruent with a MEMS, would provide an energy storage capability only a small fraction that which would be required to drive the MEMS. In other words, it would not work. To have sufficient energy storage capacity, the Shokoohi would have to have an area of 18

cm^2, as opposed to an area of 0.1888 cm^2 with the present invention. The size requirement of 18 cm^2 is due to the fact that Shokoohi's maximum current density is 0.5 mA/cm^2, as opposed to the approximately 9 mA that is needed to power a MEMS. Please note that Shokoohi et al. supports the Applicant's contention that the high temperatures needed to make solid state batteries work in the manner proposed by Shokoohi is prohibitively high. Shokoohi states as such in column 2, lines 1-18, and then again in col 3, line 58 - col 4, line 20. Shokoohi asserts the process thereof is viable, since its annealing temperatures are around 400° C (see col 6, lines 30-34). Shokoohi further states that this is sufficiently low, since common substrates, such as SI or GaAs deteriorate or decompose at 350° C - 500° C (See col 2, 7-11).

While it is true that Si substrates sometimes can survive at 400° C, any other elements of a circuit would be damaged or destroyed and thereby rendered inoperable at this temperature. For example, essentially all polymer materials would be destroyed. And since the oxygen pressure Shokoohi requires (10-100 Torr - see col 6, lines 27-29) is so high, essentially all non-noble metals would be severely oxidized. So, once again the Shokoohi battery is not directly integrable with a MEMS or like sized microcircuit.

25. The Examiner's position that the "volume required to store the energy is determined by the specific power requirements of the cell," violates basic battery design concepts. Batteries are sized and designed according to power needs, total capacity needs, and other factors such as shape constraints, temperature, and vibrational conditions. Besides stored energy (per volume) is a different parameter than the rate at which that energy can be removed (power). Thus, the Examine r again erroneously relies on hindsight to grossly misconstrue Shokoohi.

26. The Examiner states that the device of Wrighton "is useful as car battery." That is not, as a practical matter, true, and Wrighton does not claim such. Wrighton does state that the high power capabilities of the capacitor version of the Wrighton device, *might* have use in automobiles (a tenuous claim, but a little closer to reality than the statement of the Examiner). The sensor of Wrighton was made using microfabrication techniques, as has been the case with many, many other micro sensors. This is not a new thing, nor is it the basic substance of the present invention. The contribution of Wrighton is primarily involving the use of a different polymer, with certain favorable characteristics.

27. The Examiner states that the sensor of Wrighton could be integrated with the capacitor of Arledge. This is highly improbable, if not impossible, and certainly not obvious, as the processing conditions of Arledge would destroy the materials used by Wrighton. But even if this were true it is immaterial to a MEMS integratable microscopic battery, the subject of the present claims. The nexus of the present invention is provision of microscopic, high specific capacity batteries, fully integratable with MEMS size microcircuits, which may or may not include intelligent sensors. The statement of the Examiner that integration of the capacitor of Arledge with the sensor of Wrighton is obvious to one skilled in the art is false. To the contrary, one who is skilled in the art of microfabrication would know that it is impossible to integrate the sensor of Wrighton with the device of Arledge and, if inventively integrated would not result in the claimed invention.

28. I hereby declare that all statements made herein are of my own knowledge to be true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false

statements and the like so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATED this ______day of December 2002.

____
RODNEY M. LAFOLLETTE, PH.D.

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27. The Examiner states that the sensor of Wrighton could be integrated with the capacitor of Arledge. This is highly improbable, if not impossible, and certainly not obvious, as the processing conditions of Arledge would destroy the materials used by Wrighton. But even if this were true it is immaterial to a MEMS integratable microscopic battery, the subject of the present claims. The nexus of the present invention is provision of microscopic, high specific capacity batteries, fully integratable with MEMS size microcircuits, which may or may not include intelligent sensors. The statement of the Examiner that integration of the capacitor of Arledge with the sensor of Wrighton is obvious to one skilled in the art is false. To the contrary, one who is skilled in the art of microfabrication would know that it is impossible to integrate the sensor of Wrighton with the device of Arledge and, if inventively integrated would not result in the claimed invention.

28. I hereby declare that all statements made herein are of my own knowledge to be true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATED this 11th day of December 2002.

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